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ABSTRACT

A mathematics laboratory is discussed in terms of (1) administrative support, (2) personnel, (3) curriculum design, (4) flexibility in design and equipment, (5) professional counseling, and (6) motivational devices. The discussion focuses upon the remedial math lab at Alvin Community College, Alvin, Texas. The roles of instructors, lab supervisors, and peer tutors are detailed. The math lab program is flow charted and discussed in terms of procedures, materials used, and testing devices. An excerpt from a set of guidelines to math lab faculty is given to illustrate program organization at the instructor level. A basic math lab floor plan illustrates the need for flexibility. Positive attitudinal change was found with students using the lab. A bibliography and a list of 5 sources of software supplies is given. (JW)

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THE DESIGN AND OPERATION OF AN EFFECTIVE MATH LABORATORY

BEST COPY AVAILABLE

by
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SE 020 487

Ed. 1

THE DESIGN AND OPERATION OF AN EFFECTIVE MATH LABORATORY

Modern technology has brought about the introduction of much new terminology in education, either directly or as a spin-off. Such terms as programmed instruction, individualized instruction, self-paced instruction, computer assisted instruction, dial access instruction, and media oriented instruction are but a few of the plethora of terms that are banded about in today's academia.

At the outset our position, and the position supported by this paper, is to be made clear; that the most effective instruction for the total student population is that involving a close student-teacher relationship. It is the development, if you will permit, the extension, of that relationship that is the concern of this paper. The math laboratory is a special case of the student-teacher relationship, it limits the discipline to one particular area; mathematics, and the physical and sociological parameters are, for the most part, unlike those found in the traditional classroom. The parameters described herein are written in terms of remedial mathematics, although this distinction applies, with minor exceptions, only to the section on faculty and counseling.

There are certain elements upon which the success of a math lab depends. These elements will be discussed in the following

format:

- Administrative Support
- Personnel
- Curriculum Design
- Flexibility in Design and Equipment
- Professional Counseling
- Motivational Devices

Several of these components are either totally or partially beyond the control of the laboratory director. However, if the funds are available, personnel, materials, and equipment should be administratively controlled by the math lab personnel. Fig. (1) illustrates some of the elements of an individualized program.

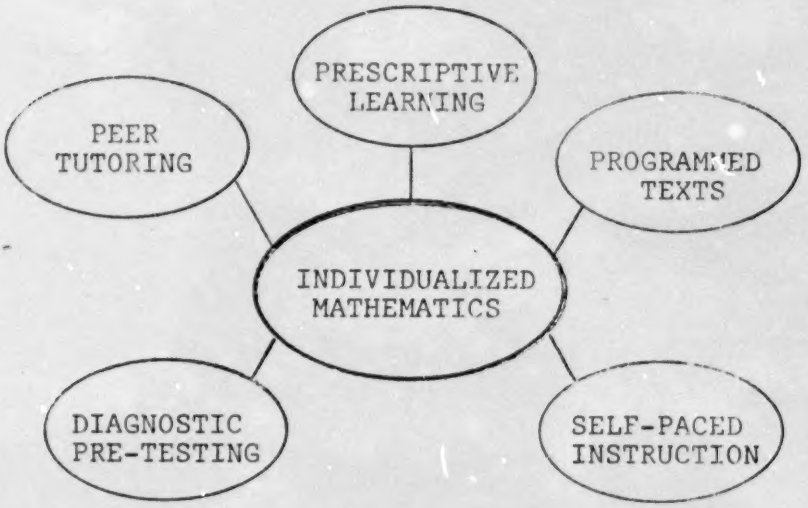

Fig. (1)

Administrative Support:

Financial Support: Math laboratories are expensive. At Alvin Community College the cost is about $60 per student, one of the most expensive of all academic programs. There must be an institutional commitment to support the program within the operating budget. Excluding faculty salaries, our annual budget is less than $10,000, of which $4,500 is for student help.

Philosophical Support: The math lab is programmed for failure or mediocrity unless it is philosophically supported by the administration. The program must be assured of a commitment that permits it to adjust and modify to fit the unique needs of the institution in which it is founded. The freedom to make mistakes must exist.

We would never assume to write the recipe by which an effectively operating math lab can be "cookbooked." Conversely, we are presenting those conditions which, when satisfied, will ensure the development of a successful laboratory. Flexibility is one of these essential ingredients, and flexibility is provided only when the administration shares the philosophy of the mathematics laboratory.

Personnel:

In our math lab, Fig. (2), we have instructors, a lab supervisor, and peer tutors directly involved with the student, while clerical personnel and typists fill a supporting role.

ORGANIZATIONAL CHART

ACC MATH LAB

- ASSOCIATE DEAN - LRC
  DON BROWN (Ph.D. in Math. Educ.)

- DIRECTOR OF FREE STUDIES DIVISION
  Presently Vacant

- LABORATORY SUPERVISOR
  ALICE HAGOOD (B.S. in Mathematics)

- FACULTY AND TUTORS

Fig. (2)

One of the greatest downfalls of a math lab, that would otherwise have the elements prerequisite to success, is the assumption, and subsequent assignment based upon that assumption, that a good instructor in the traditional classroom will be a successful instructor in the math lab. The math lab instructor must be keenly sensitive to the needs of students. This instructor must remember that a majority of the remedial students in the math lab are failure oriented, many others have been away from school long enough to have lost confidence in their abilities. The non-remedial student is working under new

circumstances that may lack the sociological enforcement of the traditional classroom. Each contact between the instructor and the student should result in a positive reinforcement for the student.

It is most imperative that those persons who come in direct contact with students be student oriented. They must be prepared to spend the majority of the day with their students, as opposed to working alone in their offices. Our lab faculty is required to spend 35 hours per week in the lab. They must be able to perceive needs and to seek out students who need help. Many of these students are extremely reluctant to ask for assistance.

Our lab is open from 8 a.m. - 4:30 p.m. during the work-week and from 6:30 - 9:30 p.m. Monday-Thursday evenings. Our lab supervisor teaches the majority of our Math 110 (arithmetic and basic algebra) students; 60 of these students, along with her many other duties, are considered a full load. The supervisor has her desk in the math lab and she is available during all day lab hours. She insures that an individual folder is kept current on each student. The lab supervisor interviews and screens tutors. Once the tutors are hired, the lab supervisor arranges their work schedules and indoctrinates them in successful tutoring. Since our lab also acts as a clearinghouse for private tutoring, she maintains a list of qualified tutors whom she puts in touch with persons seeking private tutoring.

Peer Tutoring: Instructors sometimes forget the barrier that the "power of the grade" can create in terms of effective

communications. Peer tutoring avoids this problem; students are more relaxed with their fellow students. As with any instructional person, students must respect the tutor if they are to learn, so careful tutor screening is a definite requirement.

We strongly believe in the value of peer tutors; however, we also recognize that they are young, inexperienced and require close supervision. Our lab supervisor maintains constant surveillance of the entire lab and is able to assist tutors when they require help.

We keep our lab open and staffed during the entire day because we do as much work for drop-in students seeking tutoring as we do in regularly scheduled Math 110 classes. In addition to their regularly scheduled classes, many of our Math 110 students work in the lab at other times.

I firmly believe that our personnel are the single most important factor in the success of our math lab. Our tutors are recommended to us by the mathematics department faculty; thus, we are assured of their preparation in mathematics. They then undergo a careful screening by the lab supervisor to determine their suitability for tutoring. We stress the importance of the tutor being able to distinguish between what they do and do not know and insuring that they tell the student when they do not know how to work a certain problem. Of course, they then seek help from the lab supervisor. A pleasant personality and the ability to communicate are qualities we require of all our personnel, along with having empathy for the needs of others. A tutor should never appear condescending toward a student.

We subscribe to About Tutoring which is published by the National Association of Tutorial Services. We ask all our tutors to read each issue of this publication.

Through our in-service training program we insure that our tutors are familiar with all of the materials in the lab and that they know how to operate all the media devices.

In our tutor orientation we stress certain tutoring techniques such as beginning a tutoring session by asking the student (a) to discuss his difficulty, (b) to show the tutor what work he has done, and (c) to discuss specific problems encountered in the text.

In addition to our student tutors, we have two clerk-typists who work in our lab approximately 12 hours each week. The two girls, who are majors in our secretarial science program, take care of the bulk of typing and filing chores which are so necessary to a successful math lab.

Curriculum Design:

Gurley [3:1] reached the conclusion that "In general, small group instruction is more effective than either independent study or traditional instruction in improving developmental writing skills." I suggest that this conclusion can appropriately be extended to the teaching of mathematics and that it should influence the curriculum design of the math lab.

The math lab at Alvin Community College operates along two basic approaches:

(1) Supplemental laboratory. The student is referred by

the instructor or voluntarily comes in for help in a specific area. When the student arrives in the lab, his needs are diagnosed and materials appropriate to his needs are provided. When the student completes the work assigned, an evaluation of his progress is provided to the instructor.

Many types of self-instructional materials are available to the student in the lab. We strive to offer a variety of alternate learning path materials such as programmed texts, texts supported with audio tapes or filmstrips or 35mm slides.

(2) Scheduled class (maximum of 15 students). Students may elect to take our Mathematics 110 course if they feel unprepared for regular mathematics courses. However, if an entering curriculum student scores less than 14 on the mathematics portion of the ACT or less than 10th grade on the mathematics portion of the California Achievement Test (CAT), he must take Math 110 before going on to the regular mathematics courses. Fig. (3) is a flow chart of the Math 110 program.

All Math 110 students take the math portion of the CAT, either as a screening instrument prior to enrolling in the course or after having been placed in the course by some other means. The CAT provides the basic diagnosis to determine if the student is ready for basic algebra or if he requires background work in

Page 9

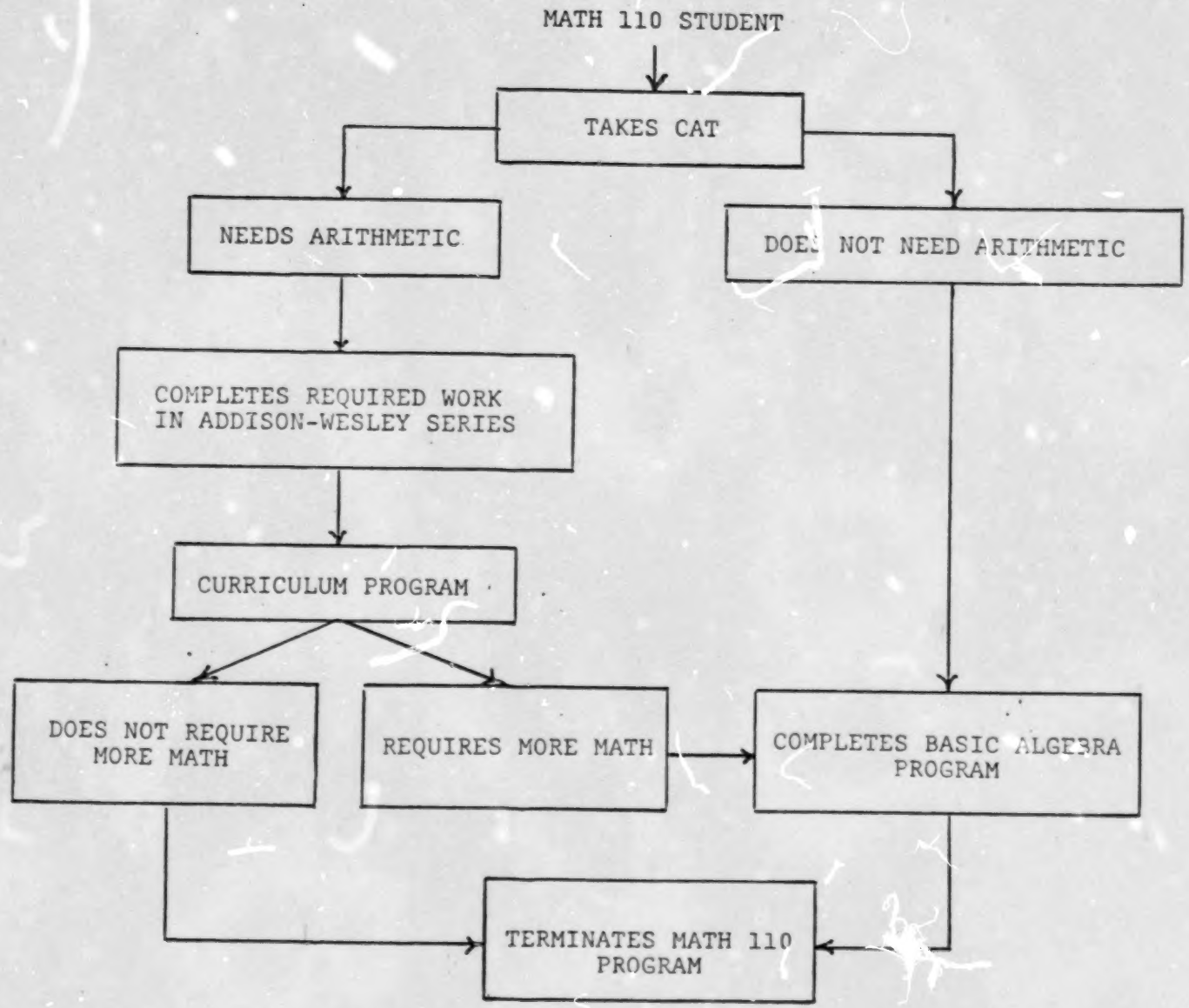
MATH 110 STUDENT
TAKES CAT
NEEDS ARITHMETIC
DOES NOT NEED ARITHMETIC
COMPLETES REQUIRED WORK IN ADDISON-WESLEY SERIES
CURRICULUM PROGRAM
DOES NOT REQUIRE MORE MATH
REQUIRES MORE MATH
COMPLETES BASIC ALGEBRA PROGRAM
TERMINATES MATH 110 PROGRAM

Fig. (3)

arithmetic. A need for arithmetic is indicated when his scores, as recorded in blocks A - G of the CAT test form, are less than:

A	B	C	D	E	F	G
11	4	4	14	14	14	14

If the CAT indicates a need in arithmetic, a close examination of the CAT Diagnostic Analysis of Learning Difficulty, see Fig. (4), is made to determine which of the four basic modules of the Addison-Wesley Arithmetic Series is needed. Once this determination is made, the diagnostic pre-test is given for that module and a plan of study is devised for one module at a time. This approach has some disadvantages. For example, it is not possible to give the student a plan of study over the entire arithmetic series since a diagnostic test is given for each module as it is begun. It is, of course, possible to give a diagnostic pre-test over the first four modules; however, I strongly argue against this because knowledge gained in Module I carries over to Module II, etc., and that a diagnostic test over Modules I-IV, given at the beginning of Module I will not accurately reflect the student's needs when he reaches Modules II, III, and IV.

The content of our instructional materials range from basic arithmetic to statistics and calculus. Of course, we teach only arithmetic and basic algebra in our Math 110 classes. The other course materials are used for tutoring and supplemental instruction. A word of caution is suggested when selecting the materials for your math lab. There is a vast array of materials available,

Diagnostic Analysis of Learning Difficulties*

California Achievement Tests—Advanced Battery

1. Reading Vocabulary

A. MATHEMATICS
- 1-15 ..... Basic vocabulary

B. SCIENCE
- 16-30 ..... Basic vocabulary

C. SOCIAL SCIENCE
- 31-45 ..... Basic vocabulary

D. GENERAL
- 46-60 ..... Basic vocabulary

2. Reading Comprehension

E. FOLLOWING DIRECTIONS
- 61, 65, 71, 72, 75 .. Directions in mathematical situations
- 63, 67, 68, 69, 70, 73, 74 .. Directions in language situations
- 62, 64, 66 .. Directions in science situations

F. REFERENCE SKILLS
- 76, 77, 81, 82 Vocabulary
- 78, 79, 80 ... Dictionary and library skills
- 83, 84, 85 .. Selecting references
- 86, 87 ..... Report outlines
- 88-92 ..... Reading a graph
- 93-102 ..... Reading a map

G. INTERPRETATION OF MATERIAL
- 120, 121, 147 Topic or central idea
- 103, 105, 106, 116, 117, 118, 123, 140, 143, 146 .. Directly stated facts
- 104, 106, 107, 109, 110, 111, 112, 113, 114, 115, 119, 122, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 141, 142, 144, 145 .. Inferences

3. Mathematics Reasoning

A. MEANINGS
- 1, 2, 3 ..... Writing integers
- 4 ..... Writing money
- 5, 6, 7 ..... Writing fractions and decimals
- 8, 9, 10 .. Roman numerals
- 11, 12, 13 .. Fractions and decimals
- 14, 15, 16, 17 Exponents and roots
- 18, 19, 20 .. Abstract numbers

B. SYMBOLS, RULES, & EQUATIONS
- 21, 22, 26, 27 Vocabulary
- 23, 24, 25, 28, 29, 30 Symbols
- 31, 32, 33, 34, 35 Rules
- 36, 37, 38, 39 Negative numbers
- 40, 41, 42, 43, 44, 45 Solving equations

* Consult Part 2 of the Manual for uses

C. PROBLEMS
- 46, 47 ..... Simple problems
- 48, 57 ..... Averaging
- 51, 52 ..... Square and cubic measure
- 49, 50, 53, 55, 56, 59 .. Ratio and percentage
- 54 ..... Budgeting
- 58, 60 ..... Insurance and discount

4. Mathematics Fundamentals

D. ADDITION
- 61, 62 ..... Simple combinations
- 63, 64 ..... Carrying
- 61, 63 ..... Zeros
- 63, 64 ..... Column addition
- 64, 66 ..... Adding money
- 64, 65, 66 ... Denominate numbers
- 67 ..... Adding numerators
- 68, 70, 71, 72, 73 .. Fract. to common denominators
- 69, 70, 71, 72, 73 .. Adding mixed numbers
- 74, 75 ..... Adding fractions & decimals
- 76, 77 ..... Writing decimals in column
- 78 ..... Adding percentages
- 79, 80 ..... Adding abstract numbers

E. SUBTRACTION
- 81 ..... Simple combinations
- 82, 83, 84, 85 Borrowing
- 83, 85 ..... Zeros
- 84, 85 ..... Subtracting money
- 84, 85, 86 ... Denominate numbers
- 87, 88 ..... Subtracting numerators
- 89, 90 ..... Fractions to common denom.
- 91, 92, 93 ... Borrowing, mixed numbers
- 94, 95 ..... Subtracting fractions and decimals
- 96, 97 ..... Writing decimals in column
- 98 ..... Subtracting fractional parts
- 99, 100 ..... Subtracting abstract numbers

F. MULTIPLICATION
- 101, 102, 103, 104, 105 ... Tables
- 102, 105 .... Zeros in multiplicand
- 104, 105 .. Zeros in multiplier
- 103, 101, 105 Two- and 3-place multipliers
- 105 ..... Denominate numbers
- 107, 109, 110, 111 .. Cancellation of fractions
- 108 ..... Multiplying numerators and denominators
- 112, 113, 114 Fractions and mixed numbers
- 115 ..... Fractions and decimals
- 116, 117 ... Pointing off decimals
- 118 ..... Multiplying per cent
- 119, 120 ... Multiplying abstract numbers

G. DIVISION
- 121, 122, 123, 124, 125 ... Tables
- 121, 122, 123, 124 ... Zeros in quotient
- 125 ..... Remainders
- 126, 127, 128, 129, 130, 131, 132, 133 ... Inverting divisors
- 131, 132, 133 . Mixed numbers
- 134 ..... Fractions in remainder
- 135, 136, 137 . Pointing off decimals
- 138 ..... Division, fractional parts
- 139, 140 .... Division, abstract numbers

5. Mechanics of English

A. CAPITALIZATION
- 2, 27, 38, 39 . Names of institutions
- 3, 18, 24 .... Titles of persons
- 4, 14, 32, 35 . Titles of literature and drama
- 5, 15, 28 .... First words of sentences
- 6, 22, 36 .... Names of persons
- 7, 10, 13, 19, 20, 23, 37 .. Names of places
- 9, 16, 30 .... Days and months
- 11, 21, 33, 40 First words of quotations
- 23 ..... Name of club
- 31 ..... Name of language
- 1, 8, 12, 17, 26, 29, 34 .. Over-capitalization

B. PUNCTUATION
- 41, 45, 49, 51, 54, 57, 58, 63, 65, 68, 71, 74, 76, 77 .. Commas
- 42, 52, 61 ... Colons
- 43, 47, 53, 59, 79, 80 .. Apostrophes
- 50, 56, 62, 70 Quotation marks
- 55, 75, 78 .. Quotations within quotations
- 44, 46, 48, 60, 64, 66, 67, 69, 72, 73 .. Over-punctuation

C. WORD USAGE
- 81, 86, 94, 100, 119, 123 .. Tense
- 82, 85, 89, 93, 95, 96, 102, 107, 110, 124 .. Parts of speech
- 83, 104, 113, 118 .. Number
- 84, 87, 90, 99, 111, 126 .. Good usage
- 88, 91, 97, 99, 103, 106, 109, 112, 114, 116, 117, 121, 125, 127, 128 .. Syntax
- 92, 101, 105, 108, 115, 120, 122 .. Case
- 129, 140 ..... Recognizing sentences

6. Spelling (141-170) See profile

Fig. (4)

but the ratio of worthwhile materials to others is quite low. Each semester we evaluate our materials and the degree to which they assist in accomplishing our learning objectives. We have been using our present basic algebra series for four years. However, we are considering a change primarily because the audio tape is directly tied to the programmed text. We find that many students are either disinterested in, or obviously annoyed by, the audio tape. We are considering a program that offers the audio tape as a supplemental aid to the programmed text. There are other aspects that we consider essential to our basic algebra program. We want the capability to plan a prescriptive program of study as the result of a diagnostic pre-test, or tests, and we want a comprehensive evaluation, upon completion of the program. The post-evaluation should relate to the pre-test in order that we can measure change and final exit level.

We believe that many programs have a weakness in that they do not obtain a total comprehensive measure that reflects some degree of retentive ability. We follow the practice of requiring the student to demonstrate a certain level of proficiency before proceeding to the next unit of work. This practice, as illustrated in Fig. (5), sometimes means that the student re-tests two or three times on a given unit. We do not suggest changing this practice; what we do suggest is that the possibility exists for students to eventually pass a given unit of work more through practice than understanding. To maintain some degree of academic integrity we must provide evidence of subject matter retention.

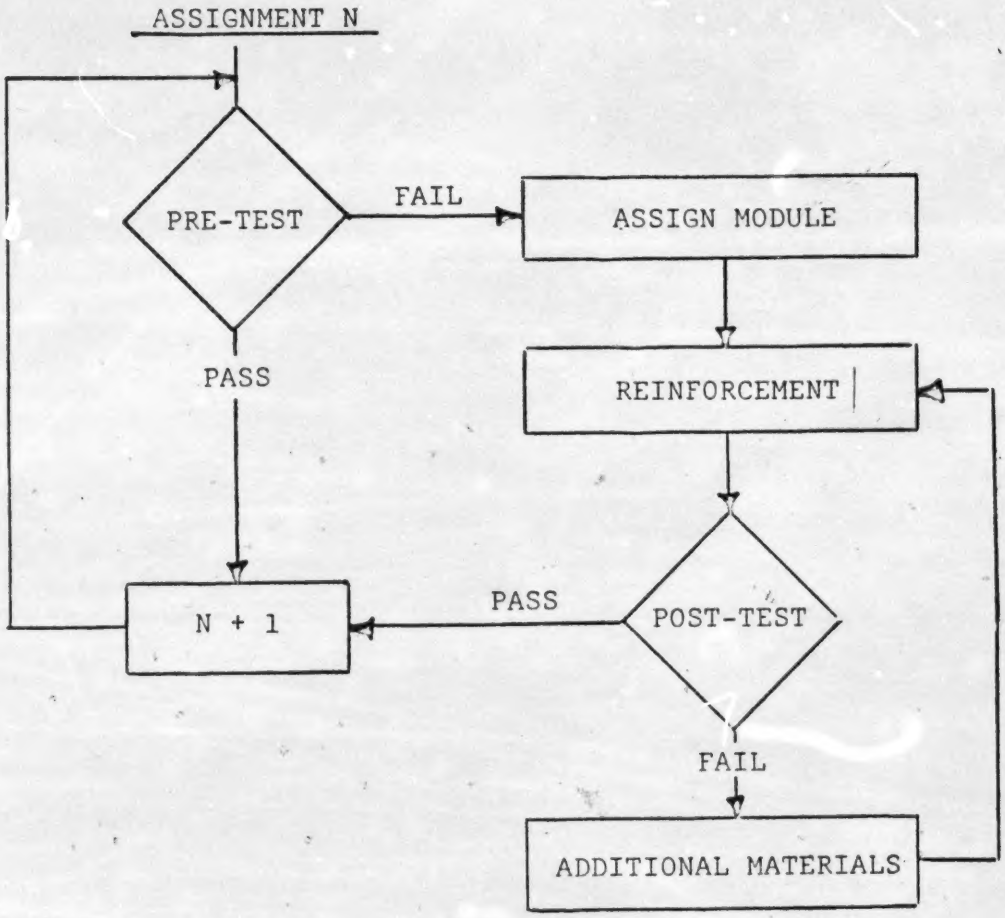
ASSIGNMENT N
PRE-TEST
FAIL
ASSIGN MODULE
PASS
REINFORCEMENT
N + 1
PASS
POST-TEST
FAIL
ADDITIONAL MATERIALS

Fig. (5)

Math labs provide a service function. The recipients of this service range from the students to the departments that will instruct the student in work dependent on the preparation received in the math lab. If the math lab is to be creditable, it must be able to exhibit a satisfaction of the objectives it claims capable of fulfilling. We believe one way of doing this is through the use of standardized exams, the results of which are somewhat above question.

The McHale-Witzke Arithmetic Series, used in connection with the CAT, satisfy our requirements for a good lab program. First, it begins with whole numbers at a basic non-tactile level. The material is presented in a manner quite acceptable to adults. There are many tests offered with this program; the tests vary from diagnostic, to unit tests, to comprehensive tests over the entire series. The diagnostic tests provide ease in prescriptive teaching, and the individual modules offer economy to those students who do not require the entire program.

As with any viable program, ours has had some problems. One of the most serious is the number of incomplete grades that we have given each semester. There are at least two factors contributing to this problem. First, we have continual enrollment in Math 110. A student can drop a regular math class at any time and add Math 110. Hence, we have students adding the class as late as the last few weeks of the semester. This factor is readily identified and accepted by all concerned since continual enrollment is encouraged in our program.

The second factor is not so readily identified, but it involves the individual nature of the program, proper administration (at the instructor level), and an immense amount of work on the part of the instructor. Most instructors who have taught both in the traditional lock-step classroom and the completely individualized program will agree that, when done properly, the individualized program approach is more demanding on the instructor's time. The following excerpt is from a set of guidelines that were provided to our math lab faculty.

(1) Prescriptive Student File:

(a) A file will be established on each Free Studies student.

(b) Initially the file will reflect the results of the prescriptive pre-test. The results will show the student's entry abilities and development needs. These needs must be translated into behavioral objectives.

(c) A precise prescriptive plan of study will be designed. This plan will be in terms of the behavioral objectives to be completed. The plan of study will extend to the exit point which will be defined for each student in terms of their goals.

(d) Each student will be given an individual one-to-one interview during the first week of class. During the initial interview the student will be apprised of the overall program and the planned

time frame for completing the program. The time frame will reflect the magnitude of the program (behavioral objectives to be accomplished) and the student's individual learning rate.

(e) Each student's file will be reviewed, with the student, every three weeks. The review will determine the student's progression in terms of the plan initially designed for the student. The plan will be amended, if necessary, with each review. The student's file will reflect all reviews, the completion of objectives, all revisions, and any counseling sessions. The file will be treated confidentially.

(2) Attendance and Scheduling:

(a) It has been, and it will continue to be, the policy of the math lab to afford the greatest possible degree of flexibility to students in terms of scheduling needs.

(b) Flexibility is not to be confused with laxity. Students will be scheduled, as much as possible, in terms of their needs. However, once the agreed on schedule is fixed, strict adherence thereto will be required. This is not to say that schedules cannot be revised. Basically, we are saying that a minimum of three hours per week will be required in the mathematics laboratory. Additional sessions

may be assigned when a student's review indicates less than satisfactory performance.

(3) Measuring Change:

(a) Just as prescriptive entry measuring instruments will be used in program design, instruments will also be used to ascertain student change (progress) and to establish the reliability of the program.

(b) Both comprehensive pre-tests and comprehensive post-tests will be administered. The results of the two tests will establish the change occurring in the student.

(c) One of the criticisms of the math lab program has been that objective attainment has been in terms of individual objectives but never in terms of retention. The comprehensive post-test will establish the attainment of exit level objectives of a comprehensive nature.

Flexibility in Design and Equipment:

Our present math lab does not depict an ideal, or close to ideal, design. We began, as many of you have or will, with what was available. We will move into a new lab in September, 1977. Fig. (6) depicts a typical math lab arrangement.

Basically, the lab should have carrels that permit the application of various media devices to support the programmed text, tables where the instructor or tutor can work with the students, a lab supervisor station raised for observation, and

small classrooms where the instructor can hold discussions with small groups (less than ten) of students.

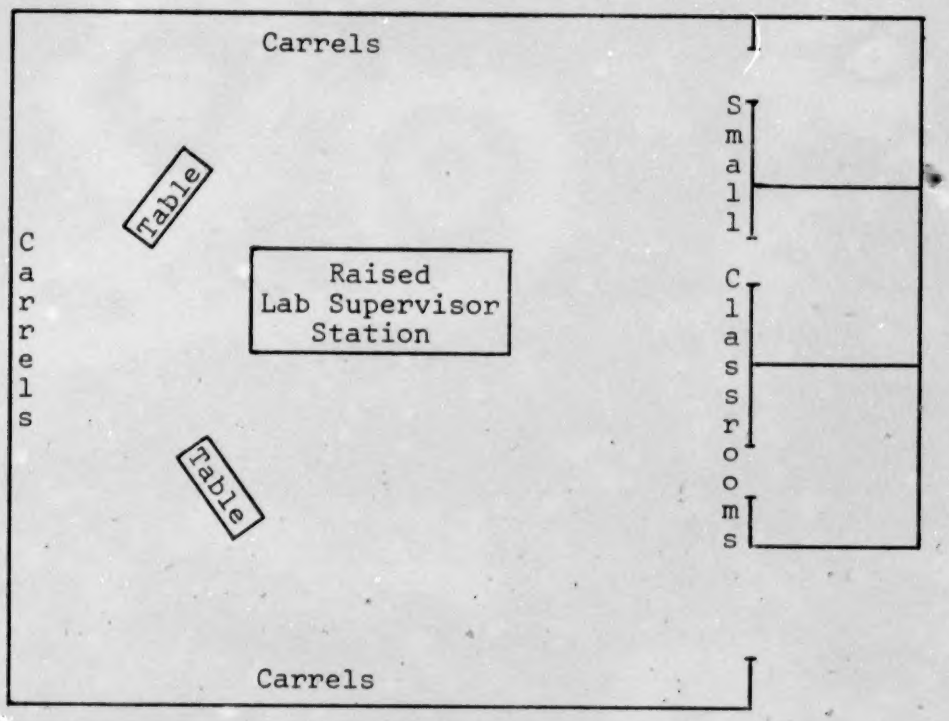

Fig. (6)

A wide assortment of equipment is in use in the various math labs that I've visited and most of the users seemed pretty well satisfied. The particular equipment design is not as important as having the kinds of equipment that insure flexibility. The equipment should enable the utilization of various types of media as opposed to being restricted to a particular type of software or perhaps a single company's products.

The following comments indicate the equipment in the Alvin Community College math lab. This equipment serves us well, but I don't suggest that you need identical equipment to be successful.

We use a carrel-to-student ratio of 1:30. Most of the carrels are equipped with Kodak Model AF-2 slide projectors. All are equipped with a Wollensak Model 2505 or 2555 cassette tape player. All of the carrels have a 90° offset projection ability in addition to a built-in screen. Our carrels can be equipped with filmstrip viewers and filmloop viewers. These viewers are available from the lab supervisor.

Sony video tape player-recorders are available so that any mathematics program available on the educational T.V. channel can be taped for use in the lab. We also have storage for a number of video cassettes that will be needed over a long period of time.

Our math lab is located adjacent to the library; hence, the microfilm reader is convenient for those students who need textbook material stored on microfilm.

Our tape duplicator is in constant use. Students are allowed to check out copies of tapes; however, they must be returned.

Professional Counseling:

Roueche and Kirk [7], in their book on remedial education, list effective counseling as one of the essential ingredients of a successful remedial program. One of the most prevalent deficiencies noted in math labs is the absence of professional counseling.

There are many causes for academic failure. Some of these causes can be successfully dealt with by the instructor. Others, however, require the assistance of professional counselors. Counselors should handle the problems resulting from emotional disorders as well as vocational counseling. Many remedial students have unrealistic goals, unrealistic in terms of their abilities. The instructor or lab supervisor, because of their close contact with the student, is in an excellent position to perceive these problems and bring them to the attention of a counselor.

Motivational Devices:

Motivation has always been the unknown quantity in education. We don't pretend to have found the panacea to this ill. What we do suggest is that any element that can be introduced into the math lab, that increases the student's interest in being there and causes him to look forward to going there, will enhance the overall success of the laboratory.

In our lab we have a computer terminal with a CRT (cathode ray tube) display. There are some arithmetic drills that can be practiced, but most of the users play skill games.

We look for skill devices that can be expected to stimulate the mind even though they may not be directly related to mathematics. Such games as chess, go, and the WFF'N Proof [13] games of On Sets, Equations, and Tri-Nim are examples of stimulating and inexpensive games that can be housed in the math lab. The game area should be located in a place that will not offer distraction to the instructional area.

IN CONCLUSION:

Our program has enjoyed some success. Followup studies show that 80% of those completing our program make a grade of "C" or better in subsequent mathematics courses. We have also administered the Aiken-Dreger Revised Mathematics Attitude Scale. On this scale, 40 is considered neutral, while less than 40 indicates a negative attitude and more than 40, a positive attitude. The mean pre-test score was 35.6 and the mean post-test score was 48.9. We believe the lab environment has contributed to an attitude change from negative to positive.

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SOURCE OF SOFTWARE SUPPLIERS

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Reading, Mass. 01867
(McHale-Witzke Arithmetic Series)
(Keedy-Bittinger, Introductory Algebra)

10. CTB-McGraw-Hill Book Co.
Order Service Dept.
Manchester Road
Manchester, Missouri 63011
(CAT Tests)

11. Lansford
P.O. Box 8711
San Jose, California 95155
(Transparencies)

12. Science Research Associates, Inc.
1540 Page Mill Road
Palo Alto, California 94304
(Math Kits)

13. WFF'N PROOF
1490-UL South Boulevard
Ann Arbor, Michigan 48104
(Math Games)